ADORE Update Version 8.00

Release Date: July 26, 2019

Along with some enhancement to life modeling techniques and continued updates of the material database, ADORE 8.00 is a major enhancement of data structure. Since the original release of ADORE in 1984, all bearing data and the last solution vector were stored in the data file MASTER. The purpose was to advance the dynamic simulations beyond the time domain simulated by an initial run by restarting the simulations from the ending time of the initial run. Since ADORE is an extremely compute intensive code, such a capability was very useful when computing speeds were slow and typical dynamic simulations required several overnight runs. The computing overhead in maintaining the required data was a small fraction of the total computing effort. Over the years the available computing speeds have increased by several orders of magnitude, which has permitted realistic modeling of very sophisticated interactions, such as coupled mechanical and thermal effects, in reasonable amounts of computing effort. However, maintenance of the data structures to permit restart capabilities has not only become increasing difficult but the computing overhead in data structure maintenance has become a significant fraction of the total computing effort. In fact, when simulations over a large time domain are required just repeating a run from time zero has become more cost effective. For these reasons, the restart capability and the data file MASTER are eliminated in ADORE 8.00. Along with simplification of data structures, this also provides a much easier path for future development.

1. Code Corrections

The temporary fix to ADORE 7.50, issued as ADORE 7.51, is now permanent. No additional issues were discovered after version 7.51.

2. Code Enhancements

Following is a list of enhancements in version 8.00:

1. The variable kIcOpt on input record 1 now has only two options: either perform quasi-static equilibrium analysis to compute initial conditions, or read initial conditions from file FINAL, possibly generated by a previous run. While this eliminates the data file MASTER, the capability to carry out perturbation analyses is still maintained by using the file FINAL.

2. Since the fatigue life modeling has now significantly advanced a simple life number in the short output produced under quasi-static option, Mode = -1 or -2, is inadequate. These modes, along with the short quasi-static output, are therefore, eliminated in Adore 8.00. For for quasi-static solutions, a dynamic solution, with kIcOpt=0 and nStps=0 on record 1 provides a more detailed output of bearing life plus other performance parameters.

3. In optional input record 2.3 the file MASTER is eliminated, since data structure for this file has been eliminated. This has also resulted in elimination of constant maintenance of transient data base and the input/output procedures for file MASTER.

4. While the options for thermal modeling on record 2.4 are moved to a new options record 3.5, the input data for thermal modeling on records 2.5 and 2.6 is also moved to the operating conditions records 9.6 and 9.7.

5. The initial operating temperature record (2.7 in version 7.51) is now moved to the operating conditions records 9.1.3. This also eliminated the problem associated with undefined temperature units during preparation of initial input data in all earlier versions of ADORE.

6. Options for materials and processing factors (kLifeMod and kProc) are now part of the materials data base. These variables are, therefore, eliminated from input record 3.3.

7. Also eliminated is numerical iterative procedure code kReEqCode on record 3.3. This code is now part of the initial data setup in ADORE.

8. The geometric imperfections records 5G are now significantly simplified. While simple geometric imperfections, such as rolling element diameter variation, may now be included in the input data, more complicated imperfections are moved to the user programmable subroutines.

9. The churning and drag record 10.7 now includes arbitrary initial churning media temperature, in addition to media pressure introduced in version 7.50.

10. Rolling element life factors are now independently computed for specified rolling element material.

11. The fatigue stress limit in the print out is now replaced by von-Mises stress of the material, which of course, permits computation of maximum octahedral shear stress which is used in fatigue limit life model.

12. With the capability for life modeling with arbitrary materials of each of the bearing races and rolling elements computation of elastic modulus factor relative to an all AISI 52100 bearing has been now eliminated. The effect of varying bearing materials is now part of basic life models in ADORE.

13. With the recent update of the REFPROP (Reference Fluid Thermodynamic and Transport Properties) version 10.0, the code in procedure Adrf3 is now completely rewritten to provide fluid properties as a function of temperature and pressure. The fluids included are: liquid oxygen (LOX), liquid hydrogen (LH2), liquid nitrogen (LN2), methane (CH4), rocket propellants RP1 and RP2, jet fuels JP10, JP8-3638 and JP8-4658, Dry Air and Water.

3. ADORE User Manual

The ADORE user manual has been appropriately updated. Major revisions are in the input data section.

4. ADORE Input Facility, AdrInput

As a result of enhancements in the data structures and reorganization of input data, the input facility AdrInput has been extensively modified. Although the data files created with earlier version of ADORE will not work with Adore 8.00, the files may be opened in the new input facility to ease data conversion. However, since some of the data has been moved to new input records, all of the data may not be converted properly. It is therefore, necessary to closely review each of the data records as they are created in AdrInput.

5. ADORE Plot Facility, AdrPlot

There are no modifications to the plot facility Adrplot in this version.

6. ADORE Animation Facility, AGORE

There are no modifications to the animation facility (AGORE).

7. Test Cases

As usual the input data, print output and all plot data sets are included in the test cases subdirectories in the program folder. These examples must be run and checked after installation of the program. All outputs, at least at step 0, must match against the supplied output.

8. Program File Contents:

Since CD is no longer a desired or preferred media on most computer systems, all software deliveries are now made via internet link for immediate download. The downloaded zip file may be easily unzipped and the software may be installed on the computer system for which ADORE is licensed for.

The media contains the following four subdirectories and a **readMe.pdf** file, which provides latest update information and instructions for quick installation on the Windows machine:

Disk1

Update800.pdf: A pdf file containing notes of the latest updates (this file).

adoreInput.txt: A text file containing details of ADORE input data.

adoreManual.pdf: ADORE user's manual.

Ball: Subdirectory containing ball bearing test case.

Roller: Subdirectory containing roller bearing test case.

TaperedRoller: Subdirectory containing tapered roller bearing test case.

AdrxExamples: Subdirectory containing few of the user programmable examples.

Disk2

***.f files:** ADORE FORTRAN-90/95 source files.

makeIntel.txt: Makefile for Windows machine with Intel Fortran compiler.

makeLahey.txt: Makefile for Windows machine with Lahey Fortran compiler.

makeUnix.txt: Makefile for Intel compiler on a Unix and/or Macintosh operating system.

Disk3

Java: Subdirectory containing all Java source files.

Disk4

This is newly introduced directory with Adore 8.00. For convenience, it contains immediately usable executable files for both Windows and Macintosh operating systems. Of

course, all executables may be created by compiling the source codes supplied in Disk2 and Disk3 directories. The contents of Disk4 directory are as follows:

Windows: Windows subdirectory

Adore800.exe: Adore executable
AdrInput.jar: AdrInput (Java executable)
AdrPlot.jar: AdrPlot (Java executable)
Agore.jar: Agore (java executable)

Mac: Macintosh subdirectory

Adore800: Adore executable (Unix executable for Mac)
AdrInput.jar: AdrInput (Java executable)
AdrPlot.jar: AdrPlot (Java executable)
Agore.jar: Agore (java executable)

While ADORE is a command line applicable and it must be executed on a command line in appropriate directory containing the input data file DATA.txt, the java applications may be executed by a simple double click on the application icon. On command line the application may be executed by invoking the following command:

java -jar *jarFileName*

where *jarFileName* may be AdrInput.jar, AdrPlot.jar or Agore.jar. Of course, the path for the jar file must be satisfied.

9. Program Installation

Quick installation steps are outlined in the readMe.pdf file supplied on the program disk. More detailed installation instructions are included in the users manual.

9.1 ADORE Installation

Make files are provided in Disk2 directory for easy installation of ADORE for both the Intel and Lahey compilers for a Windows machine. The nmake command available with these compilers may be used to compile and create an executable code. In addition a make file is also included for a Unix operating system, running an Intel FORTRAN compiler. This file may also be used on a Macintosh computer, since Mac OS is essentially based on Unix.

In case of other computing platforms and/or operating systems, any of the supplied make file may be appropriately edited and used for ADORE installation.

9.2 Installation of Java facilities AdrInput, AdrPlot and Agore

Starting with Adore version 8.00, the freely available **Netbeans 8.2** Java Development IDE is used to create the java executable jar files as supplied in the Disk4 directory. This eliminates the more complicated command line procedures used in all earlier versions of ADORE. Netbeans 8.2 may be freely downloaded from Oracle website. This requires Java 1.8 Java Development Kit, which is also available from Oracle website. The Java JDK must be installed before installing Netbeans.

The jar files so created with Netbeans 8.2 are self-contained and do not require specification of any classpath statements. Also, since most Java applications are platform independent, the jar files may be used on both Windows and Macintosh operating system.

Please see the user manual or the ReadMe.pdf file for more details on using Netbeans 8.2 for compiling the java applications.

10. Contact Information

In the event of any questions and/or technical support please contact:

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